

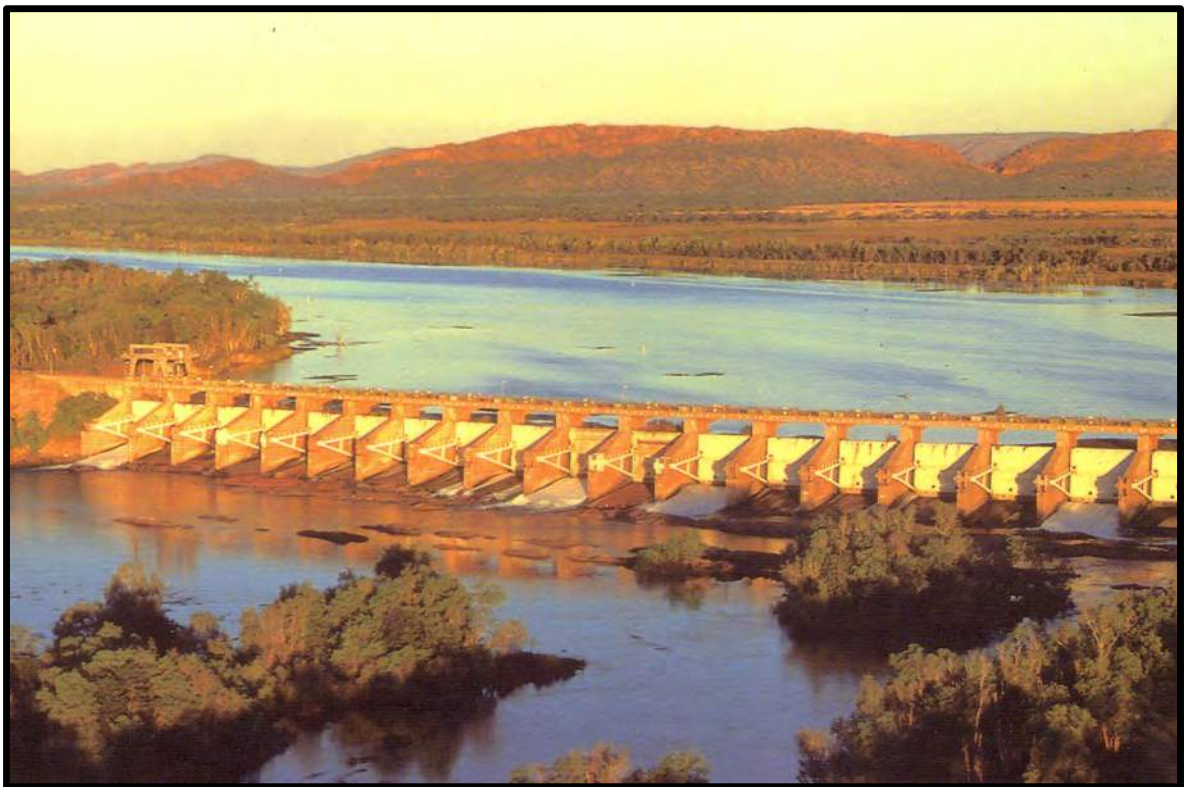
ENGINEERS AUSTRALIA
Western Australia Division



ENGINEERS
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CEREMONY REPORT

ORD RIVER DIVERSION DAM



Heritage Recognition Ceremony

Kununurra, Western Australia, 20 July, 2013

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1. Introduction

The Ord River Diversion dam was the key piece of infrastructure in the first stage of the Ord River Irrigation Project. The dam was awarded an Engineering Heritage Marker in 2013 by Engineering Heritage Australia. The dedication ceremony took place at Kununurra on Saturday, July 20, 2013, 50 years to the day after the official opening of the project by the then Prime Minister of Australia, Sir R. G. Menzies.

2. Ceremony and Distinguished Guests

The ceremony, which was jointly organised by the Owner, the Water Corporation of Western Australia, and Engineers Australia, WA Division; was attended by over fifty guests, including representatives of the Water Corporation, Engineers Australia WA Division President, Mrs Helen Pedersen, former PWD WA and Christiani Nielsen Clough staff who had been involved with the design or construction of the project, members of the Kununurra Historical Society; local dignitaries and relatives of engineers and administrators who had been closely associated with the original irrigation project.

A full list of invitees, attendees and apologies is included in Appendix 1. Distinguished guests who were acknowledged are mentioned in the introductory notes and speech notes (Appendix 2). A facsimile of the Interpretation panel was mounted on a table before being jointly unveiled by Ms Eva Skira, Chairman of the Water Corporation and Mrs Helen Pedersen. It was subsequently presented to the Kununurra Historical Society and is displayed in its museum. The permanent interpretation panel and the Engineering Heritage Marker were subsequently placed in position at an appropriate viewing area near the east abutment of the dam. See Figure 1.



Figure 1. The interpretation panel and marker in place

3. Program and Speeches

The Master of Ceremonies was Past Engineering Heritage WA Chairman, Mr Don Young, who was Deputy Project Manager for the construction contractor, Christiani Nielsen Clough in 1961 – 1962. Speeches were delivered by Mrs Helen Pedersen, Mrs Sue Murphy, Chief Executive Officer of the Water Corporation, and Ms Eva Skira. See Appendix 2 for speech notes.

At the conclusion of the ceremony guests were taken on a bus trip across the roadway that spans the radial gate openings to a viewing area on the west bank of the river downstream of the dam.

4. Ceremony Brochure

A ceremony brochure, jointly designed by the Water Corporation and Engineering Heritage WA, was produced by the Water Corporation. See Appendix 3.

5. Media Articles

The Water Corporation prepared a press release for the ceremony. A copy dated 22 July 2013, with corrections prepared by EHWA, is included in Appendix 4.

The Kununurra local newspaper, the Kimberley Echo, published an article : **Dream of the north becomes reality**, dated 18 July, using information submitted by the Kununurra Historical Society.

Engineers Australia WA Division, in a late July electronic news bulletin, included an article prepared by EHWA.

West Australian Newspapers in its August Engineering Week supplement, published an article headed **Ord River meanders its way home**.

Engineers Australia Magazine, published an article, entitled **Heritage Marker for Ord River dam** on page 25 of its August edition.

The Kimberley Society published an article entitled **Ord River Diversion Dam 1963-2013** in the Boab Bulletin, its monthly newsletter.

Finally the EHA Magazine Vol 1, No. 1 dated December 2013 included an article **The Start of a New Era 1963, The Ord River Diversion Dam and the Ord River Irrigation Project**. See pages 14 & 15.

6. Costing

Item	Cost	Source of funding
Panel Design	\$528	EHA
Marker	\$200 approx.	EHA
Panel manufacture	\$2558	Water Corporation
Panel delivery (Perth Metro)	\$110	EHWA
Panel delivery (to Kununurra)	N/A	Sadleirs-Nexus
Panel Installation	N/A	Water Corporation
Ceremony Travel (2 x EHWA members)	\$2722	EHWA

The cost of producing the ceremony booklet, hire of ceremony seating, etc., catering and bus trip across the dam were all met by the Water Corporation.

7. Interpretation Panel

The interpretation panel design is shown in Appendix 5. The panel is vitreous glass enamel, 1200 mm wide and 600 mm high. It is fixed to a powder coated galvanised frame and the standard 300 mm EHM marker is bolted to a 3 mm thick steel plate spanning between the legs of the frame. The panel is installed near the east abutment of the dam. (Figure 1)

8. Photographs



Figure 2. MC Past EHWA Chairman Don Young addressing guests at the commencement of the dedication ceremony (Photo: Emily Hunter)



Figure 3. Engineers Australia WA Branch President Helen Pedersen at the rostrum (Photo: Mike Taylor)



Figure 4. Water Corporation Chief Executive Officer Sue Murphy addressing the audience (Photo: Kununurra Historical Society)



Figure 5. Water Corporation Chairman Eva Skira (left) and Helen Pedersen unveiling the interpretation panel (Photo: Mike Corboy)



Figure 6. Eva Skira making her acceptance speech (Photo: Emily Hunter)



*Figure 7. John Lewis and family.
Back row from left Joel and Tom Medalia (grandsons), Lindsay Medalia
(son in law)
Front row Geoffrey Lewis (son), John Lewis, Anne Hammond (sister),
Susan Medalia (daughter)*

(Photo: Mike Taylor)



Figure 8. Group Photo at Swim Beach (Photo: Mike Corboy)



Figure 9. Group Photo at Swim Beach, with names (Photo: Mike Corboy)

APPENDIX 1 – List of Invitees

Name	Affiliation	A c c e p t	A p p o i
Hon Richard Court AC	Patron, Kununurra Historical Society		x
Mr Barry Haase MLA	Federal Member for Durack		X
Mr Terry Redman	Minister for Water WA Govt		X
Ms Eva Skira	Chairman, Board of Water Corporation of WA	X	
Mrs Sue Murphy	Chief Executive Officer, Water Corporation of WA	X	
Lady Doris Brand	Widow of Sir David Brand		X
Mr John Lewis	Engineer PD&I Hydraulics Section PWD 1954-1964	X	
The Hon Brendan Grylls MLA	Minister for for Regional Development WA Govt		X
Ms Josie Farrer MLA	Member for the Kimberley WA Govt		X
Mr Peter Moore	Chief Operating Officer Water Corporation of WA	X	
Mr Chris Gunby	Department of Water WA	X	
Mr Andrew Barker	President Kununurra Historical Society	X	
Mrs Helen Pedersen	President Engineers Australia WA Division	X	
Professor Mark Bush	Chairman Engineering Heritage WA		X
Mr Roger Bulstrode and Aileen	ex PWD WA	X	
Mr Mike Corboy and Merlene	do.	X	
Mr Robert Pritchard and Cecily	do.	X	
Mr Greg Hunt	Representing the late Mr Harold Hunt	X	
Mr Craig Munro and Mr Stuart Munro	Representing the late Mr Don Munro		X
Mrs June Webster and Michael Webster	Representing the late Mr Kenneth Webster	X	
Mrs Rosalie Hamilton	Representing the late Mr Roy Hamilton	X	
Mr Mike Taylor & Geraldine	EHWA	X	
Mr Peter McAllister	Water Corporation of WA	X	
Mr Gilbert Marsh	ex MRWA		X
Mr Geoffrey Lewis	Son of Mr John Lewis	X	
Mr Birger Ott Nilsen and Marlene Auld	Son of the late Mr Leif Ott Nilsen	X	
Mr Don Young and	ex Christiani - Neilsen Clough and EHWA	X	

Leith			
Mr Peter Knight and Glen	ex Christiani - Neilsen Clough	X	
Mr Tony Quinlan	do.		X
Mr Dennis O'Brien	do.		X
Mr Harold Clough	do.		X
Mr Uffe Hansen	do.	X	
Mr John Youlden	Shire of Wyndham East Kimberley	X	
Mr Gary Gaffney	do.	X	
Mr Lindsay, Sue, Joel and Tom Nedalia		X	
Ms Wendy Carter and partner	Kununurra Historical Society	X	
Ms Jane Harman	do.	X	
Mr Barry McKinlay	do.	X	
Rada and Charlie Biorac	do.	X	
Ms Connie Prussian and Bruce Ellison	do.	X	
Ms Barbara Grylls	do.	X	
Crystal and Karen Richards		X	
Ms Perpetua Clancy			X
Ms Patsy Millet			X
Mr Steve Sillifant	Water Corporation of WA	X	
Mr Andy Vale	do.	X	
Mr Tom Pearce	do.	X	

APPENDIX 2 – Speech Notes

Introduction Notes for MC Don Young

1. ACKNOWLEDGEMENT OF TRADITIONAL OWNERSHIP OF LAND

Firstly I would like to acknowledge that we are holding this ceremony on land whose traditional owners are the MIRIUWOONG AND GAJERRONG PEOPLE

2. FORMAL WELCOME

Secondly on behalf of the Water Corporation and Engineers Australia I extend to you all a warm welcome and thank you for accepting the invitation to this ceremony. I know that many of you have travelled a long way to be present.

3. DISTINGUISHED GUESTS

I would like now to welcome distinguished guests :-

Ms Eva Skira, Chairman of the Board of the Water Corporation, Mrs Sue Murphy, Chief Executive Officer of the Water Corporation, Mrs Helen Pedersen, President, Engineers Australia Western Australia Division, Mr John Youlden and Mr Gary Gaffney, respectively President and CEO of the Shire of Wyndham East Kimberley, Mr Andrew Barker, President of the Kununurra Historical Society, Mr John Lewis, PWD Engineer for Planning and Design, Hydraulics Section 1954 – 1964, who was responsible for the design of the Ord River Irrigation Project, Mr Uffe Hansen, who was a Senior Engineer of Christiani & Neilsen of Copenhagen, the lead partner in the main construction contractor joint venture of Christiani Nielsen Clough.

I would also like to acknowledge the attendance of Mr Greg Hunt, son of Mr Harold Hunt, the PWD Construction Manager for the original scheme and Mrs June Webster, widow of Mr Ken Webster, who was the Lead Civil Design Engineer for the project and Mrs Rosalie Hanilton, widow of the PWD Resident Engineer, Mr Roy Hamilton.

4. APOLOGIES

Apologies have been received from Professor Mark Bush, Chairman Engineering Heritage WA, (I am deputising for him today), Lady Doris Brand, The Hon Richard Court, Mr Terry Redman, MLA, Minister for Water, Mr Brendon Grylls, MLA , Minister for the Regional Development , Ms Josie Farrer MLA, Minister the Kimberley, Mr Harold Clough, Mr Craig Munro, son of Mr Don Munro who was PWD's Project Engineer for the original scheme, and Ms Perpetua Clancy.

Last month I was in Denmark and caught up with Lisbet and Bent Ludvigsen. Bent was, among other things, the Engineer in charge of the precasting and erection of the bridge beams and stayed on at Kununurra until the construction project was complete. They asked me to convey their best wishes to all at this ceremony.

5. INTRODUCTION OF MRS HELEN PEDERSEN

Helen graduated from the University of WA with a degree in Civil Engineering in 1981. She has had a wide range of experience in design and construction of the components of process plants and has been a lead engineer on major iron ore developments. She has had a long association with Engineers Australia as a volunteer and office bearer and is currently 2013 WA Division President and a National Congress member. She places great

importance on the attraction of students into engineering and in their development as graduate engineers. She currently chairs Engineers Australia's Education Subcommittee. I now ask her to give an overview of Engineers Australia's Engineering Heritage Recognition Program.
Thank you Helen.

6. INTRODUCTION OF MRS SUE MURPHY

It with particular pleasure that I introduce our next speaker – Sue Murphy, a former colleague at the Clough Engineering Group.

Sue graduated with an Honours Degree in Civil Engineering from the University of Western Australia in 1979 and immediately joined the Clough Engineering Group where she worked in a number of roles for the next 25 years, culminating in becoming the first female member of the Board of Clough Engineering Limited in 1998.

In 2004 she joined the Water Corporation in a senior management role and four years later she was appointed Chief Executive Officer.

I now invite her to address us on the topic : The Ord River Diversion Dam
Thank you Sue

7. UNVEILING OF THE INTERPRETATION PANEL

Up to the end of 2008 Engineering Heritage Australia recognised worthy engineering heritage projects with the casting and fixing to a structure of a bronze plaque. From memory the maximum number of words which could fit on these plaques was about 80. The current procedure is to design a free standing vitreous glass enamel panel 120 cms by 60 cms with a descriptive text and photographs and I think you will agree when it is unveiled that it is a big improvement on the old system.

I now invite Eva Skira and Helen Pedersen to come forward and unveil the panel.

8. ACCEPTANCE SPEECH BY MS EVA SKIRA

Our next speaker will be Eva Skira. She has had over 17 years experience as a board member and Chair of many business, governmental and not –for - profit organisations. She has Australian and overseas educational qualifications and experience in banking, stockbroking and finance.

I had the pleasure of serving on the Water Corporation Board with Eva
She was re -appointed to the Water Corporation Board in 2011 and to the Chair in 2012.
Eva will accept the Engineering Heritage Award on behalf of the Water Corporation.

Thank you Eva

9. CLOSING REMARKS

What has been unveiled today is a full size PVC facsimile of the steel backed vitreous glass enamel sign which will be supported on two legs and concreted into the ground at a later date.

Many of us here appreciate the excellent work the Kununurra Historical Society has done over past years in recording the relatively brief history of the Ord River Irrigation Region and on behalf of the Water Corporation and Engineering Heritage WA I would like to thank the Society's President Andrew Barker for the support he and his committee have given in bringing this ceremony to fruition and have pleasure in asking him to accept the facsimile panel for display in the Society's Museum.

I would also like to thank the Shire of Wyndham East Kimberley for its assistance, the Water Corporation Kununurra staff and last but by no means least, Emily Hunter, Water Corporation Community Engagement Officer, for all the hard work she has done in arranging this ceremony.

As the program states a conducted walk across the dam will now take place followed by lunch back here at 12 noon. Due to safety concerns a bus will now take you all across the dam. Please board the bus which is parked on my left.

For those who are interested the Kununurra Historical Society Museum at 72 Coolibah Drive will be open to visitors from 2 pm until 5 pm.

THANK YOU ALL FOR ATTENDING

Speech Notes of Helen Pedersen

Distinguished Guests, Ladies and Gentlemen, Good Morning

I have been overwhelmed by the number of people who have journeyed here today to mark this event. Many of you have a long association with this place and with each other. It is an indication of your pride in your achievements and your bonds with each other that you gather here, and I honour you for it. It was a privilege to sit at dinner with many of you last night and to hear your stories – engineers and partners of engineers who lived and worked here.

One of Engineers Australia's roles is to celebrate engineering. Another is to be the custodian of engineering knowledge. Yet another is to raise the public profile of engineering. Here today we bring these three roles together. By heritage recognition of this project, we celebrate the engineering effort and achievement of this major project, we record how it was done and we bring these feats further into the public consciousness.

It was with great pleasure that I accepted the invitation from Engineering Heritage WA to come up to Kununurra to be part of this commemoration ceremony for the award of an Engineering Heritage Marker to the Ord River Diversion Dam.

This ceremony is the 171st celebration of Engineering Heritage Australia's Heritage Recognition program. These ceremonies have occurred over a period of 29 years, commencing in 1984.

The sites recognised to date are located in every State and Territory and cover many aspects of our engineering heritage including bridges, dams, roadworks, pipelines and

pumping stations, railways, ports, agricultural machinery, computers, industrial plants and many other categories of engineering achievement.

Each site is accompanied by a fascinating story documented by the researchers of Engineering Heritage Australia, which fits into the broader history of our great country. For each successful award Engineering Heritage Australia provides a 300mm marker circular disk and the nominating body has designed and unveiled a 1200mm x 600mm Interpretation Panel.

Engineering Heritage Western Australia has been very active in this program in recent years. Sites recognised in WA are:

- The Mitchell Freeway Stage 1, a feature of which was the extensive consolidation of the Narrows Interchange area by sand draining, a world class civil engineering achievement.
- The Fremantle Fortress World War 2 Coastal Defence Facilities, which incorporated two 9 inch ex-naval guns at Oliver Hill. The Army Engineer in charge of the construction of those facilities in the late 1930s was Brigadier Frank Hussey, who after retirement from the army became Deputy Resident Engineer on the Diversion Dam.
- The Western Australian Standard Gauge Railway Project which build standard gauge railway track and facilities from Kalgoorlie to Kwinana and modernised the State's railway facilities.
- Perth's first public water supply scheme, bringing hills water from Victoria Dam to Mt Eliza, completed in the 1890s.

In 2011 Engineering Heritage Australia introduced a new category of award, the Engineering Heritage International Landmark, and last year Engineering Heritage WA successfully nominated the NASA Space Tracking Station at Carnarvon for this international award. A commemoration ceremony held at Carnarvon last June was attended by a number of tracking station staff who were closely associated with the moon landing on July 21, 1949, 44 years ago tomorrow, and the guest of honour at the ceremony was Buzz Aldrin.

The nomination for the award of an Engineering Heritage Marker to the Ord River Diversion Dam was prepared by Mark Bush and Don Young, with valuable assistance from former PWD Engineer for Planning, Design and Investigation, John Lewis. The research drew liberally upon a number of articles which appeared in Christiani and Nielsen's company magazines prepared by Leif Ott Nilsen. Mr Andrew Barker, President of the Kununurra Historical Society also provided information from the Society's archives.

I was reminded strongly last night and again here today that projects are about people. Watching the engineers, with their shared histories around this project, reminisce was an incredible reminder that engineering is not only about building infrastructure, but also about building communities.

The Ord River Diversion Dam is a fitting addition to the list of Australian engineering projects which have been recognised by Engineering Heritage Australia.

Speech Notes of Sue Murphy, Chief Executive Officer, Water Corporation of Western Australia

Distinguished guests, Ladies and Gentlemen,

I am thrilled to be here today and to be part of this event to recognise an icon of Australian engineering.

I feel particularly lucky to be personally involved because this dam has been a backdrop to most of my working life. I spent the first twenty five years of my engineering career at Clough Engineering and knew by heart the legends of constructing the Ord Diversion Dam. The leaders of Clough were shaped by the scale and remoteness of the project and it was a crucible for forging the innovative and resilient organisation that Clough became. I then moved to the Water Corporation and now have the privilege of leading that iconic organisation so I technically now “own” the very dam that I used to relate stories of to Clough’s incoming new engineers.

I thus feel uniquely placed to share with you a little of that story.

For fifty years this diversion dam has provided a reliable supply of water to irrigators, hydro power generator and the ecosystem of this mighty river and is a credit to all who were involved in its planning, design and construction.

It is also a credit to all the people who have kept it operating efficiently in that time, including the present Water Corporation team under Steve Sillifant, our East Kimberley Operations Manager, and Andy Vale, our Civil Team Leader.

Given the parched state of our southern dams, the volumes of water involved here are mind boggling.

The discharge through the gates is about 337 gigalitres, or billion litres annually - which is a quarter more water than used by the whole of Perth. When you compare that to the recent years’ inflow into Perth’s dams of only about 30 Gl per annum it puts the scale into perspective.

This discharge includes a permanent flow to support the down-river environment and supply to the downstream irrigation scheme.

Of course, the dam also plays a vital role in the greater irrigation scheme.

The irrigation area now includes more than 80 farms covering almost fifteen thousand hectares producing more than 60 crop varieties including fruit, vegetables, rice, sorghum and sandalwood representing a \$120 million annual economy.

Of course, under the stage two development that was launched in 2010, the area will more than double, with considerable returns to WA.

I wonder if those associated with the dam’s construction, some of whom are with us today, ever imagined such a result.

Damming the Ord River was first officially mentioned in the early nineteen hundreds, and by the late nineteen thirties, the State Government was investigating establishment of an irrigation scheme.

A fledgling research station was set up, followed five years later by the Kimberley Research Station, a joint venture between the State and Federal governments. Because of the exciting potential benefits of harnessing the huge volumes of water that crash down the river course in the wet season, events moved inexorably towards construction of a dam.

Finally, the Federal Government came good with a grant of five million pounds, a lot of money then, to the WA state Government.

Most of this was to construct the diversion dam, pumping stations and irrigation channels including the M1 main channel, plus establishment of the town of Kununurra. Overall responsibility for planning and supervision of the scheme rested with the then Public Works Department.

Because of limited funding the diversion dam was built before a main storage dam further upstream.

This was not usual engineering practice, which would have been to build a storage dam to maintain stable water levels in the diversion dam.

This issue was resolved by the inspired incorporation of 20 radial gates in the diversion dam to release flood waters.

This idea belonged to John Lewis, and it is wonderful to have him here today. John was the PWD's Engineer in charge of Planning, Investigations and Design, and had some years earlier visited a dam in the US state of Montana which had four radial gates.

The US Bureau of Reclamation generously supplied the drawings of those gates for our dam free of charge.

Most of the detailed design of this dam's mechanical and electrical engineering works, and concrete and earthworks was carried out by the PWD which constructed models in Perth to test hydraulic calculations and assumptions.

The Main Roads Department was entrusted with design of the roadway over the spillway.

In July, 1960, the contract for site construction work was awarded to a joint venture between Christiani and Nielsen of Copenhagen and J. O. Clough and Son of Perth. Another contract was awarded to Vickers Hoskins of Perth for prefabrication of the radial gates.

Preliminary site work was carried out before the start of the 1960-61 wet season, then work resumed in earnest in March, 1961, and the dam was completed in good time for

the then Prime Minister, Sir Robert Menzies, to officially open it on this day fifty years ago.

The dam's spillway is 335 metres long.

A total of 41,000 cubic metres of concrete and 650 tonnes of reinforcing steel was used for it, while 350,000 cubic metres of fill was used to construct 4.8 kilometres of levee banks.

Just getting the materials to site was a major venture.

All of the construction materials, except concrete aggregates, were shipped from Fremantle to Wyndham then transported 100 kilometres to site by road.

The State Shipping Service vessel, SS Dulverton, was converted to carry a total of 15,000 tonnes of bulk cement – the first such bulk transport in Australia.

The crew were so proud of the feat, they prepared a commemorative plaque that is now mounted on the monument at the dam.

But while the transport logistics were complicated, it must have been nice to manage a project where all the external interference from clients and designers was literally a month away leaving the site team to make decisions as they saw fit. No email, no faxes, no computers – just sea mail and the occasional visitor.

The radial gates, manufactured in Perth and assembled on site, are each 15 metres wide, 11.3 metres high and weigh 96.5 tonnes.

The gates are operated two or three times on most days of the year to adjust for varying flows from the hydro power plant at the main dam and for demand from the irrigation scheme.

This rate is of course much higher in wet seasons due to rainfall inflows to the river between here and the main dam.

While the irrigation scheme has had its ups and downs over the years, it is now well established as an important agricultural area.

It could not have happened without the excellent contributions by a lot of people who planned and built this dam as well as the main Ord Dam, which was completed nine years later, and all the irrigation channels and infrastructure.

I would like to acknowledge the parts played by some of those in the first stage of the scheme:

They are the then Premier of Western Australia, Sir David Brand.

The Minister for the North West, and subsequently Premier, Sir Charles Court.

Mr Don Munro, Public Works Department Project Engineer,

Mr John Lewis, Engineer for Planning, Design and Investigation, Public Works Department, who fortunately is with us today.

Mr Harold Hunt, Construction Manager, Public Works Department, who is represented by his son, Mr Greg Hunt

Mr Roy Hamilton, Resident Engineer, who is represented by his widow, Mrs Rosalie Hamilton.

And last but not least,

Mr Leif Ott Nilsen, who was Manager of Christiani and Nielsen, Australia, the senior partner in the Christiani Nielsen Clough joint venture, which was the main constructor contractor for the Diversion Dam. He is represented here by his son, Mr Birger Ott Nilsen.

All these people are recognised on the heritage interpretation panel which will shortly be unveiled.

There are a number of other engineers and administrators who were involved in the Diversion Dam project who are with us today

I refer to Mr Mike Corboy, Mr Bob Pritchard and Mr Roger Bulstrode of the former Public Works Department, and Mr Uffe Hansen, Mr Don Young and Mr Peter Knight, of the Christiani Nielsen Clough Joint Venture.

I would like to specially acknowledge the presence of Mrs June Webster, whose late husband Ken was the lead civil engineering design engineer for the dam, and who subsequently became the last Chairman of the Water Authority of Western Australia.

I hope our visitors enjoy their time here, and if you have any queries about the system, please put them to Steve Sillifant who will conduct the tour across the dam.

Speech Notes for Ms Eva Skira, Chairman, Board of Water Corporation of Western Australia

I thank Engineering Heritage Western Australia, in particular Mr Don Young, and Engineers Australia for their efforts to secure well- deserved national heritage recognition for this diversion dam.

Its construction was considered a significant technical achievement given the remote site, basic communications, with no telephone link to the south, and difficult seasonal climatic conditions, including the huge river flows during the wet season.

To make it even more difficult, there was no access in those pre-resource industry days to specialised manufacturing, contracting and service industries in the state's north.

The diversion dam was the first major civil engineering project constructed by private enterprise for the PWD.

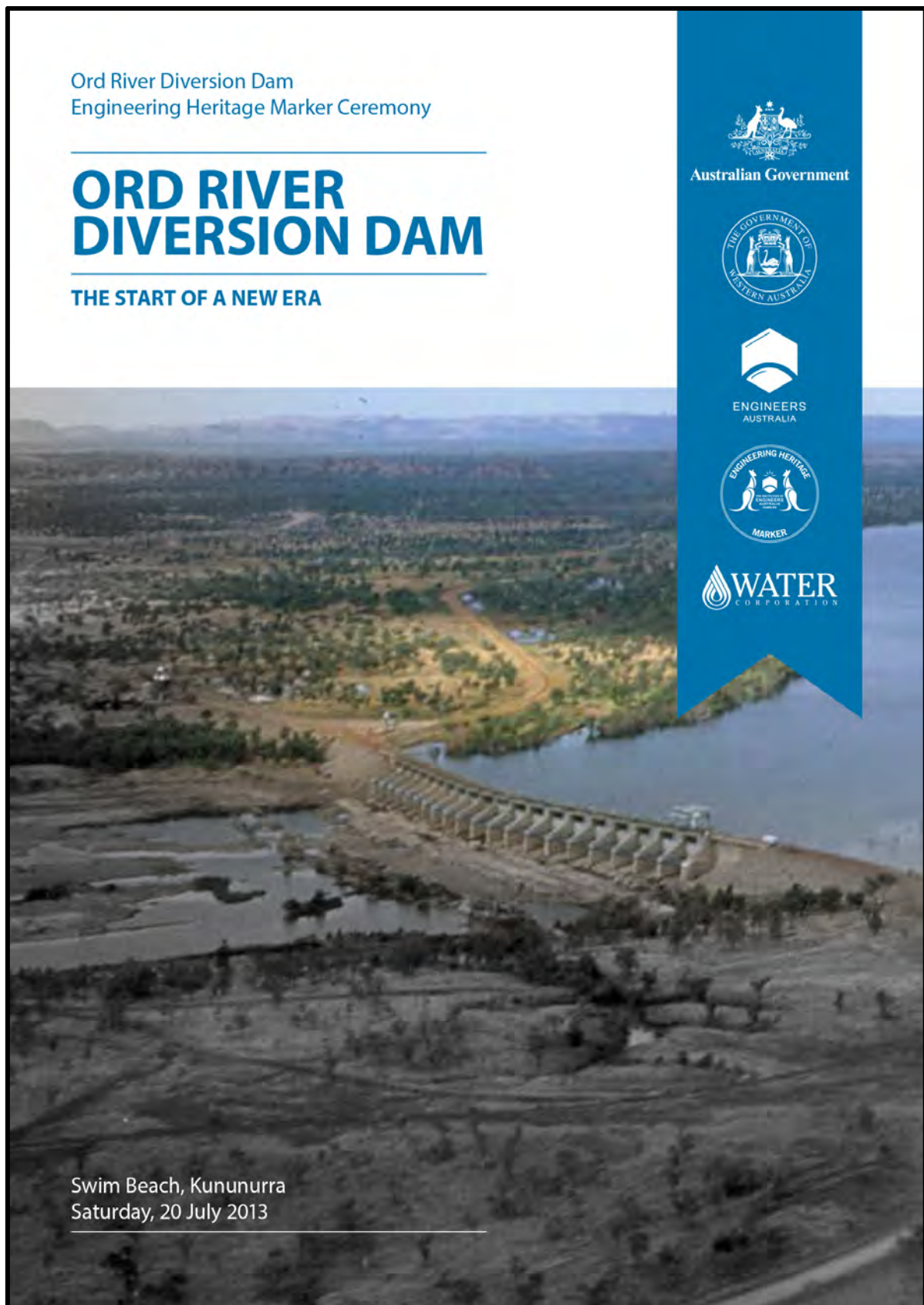
And it was one of the first two dams built in Australia incorporating radial gates, the other being the Keepit irrigation dam in New South Wales, completed in 1961.

The dams shared the same drawings used for the gates in the US dam that Sue Murphy referred to a moment ago.

The Ord River Irrigation scheme brought new life to this region including establishment of Kununurra, sealed roads and a consequent escalation in tourism.

No doubt, the diversion dam will continue in its role as water provider for many more years to come.

APPENDIX 3 – Ord Div Dam 2013 Commemorative Booklet



Ord River Diversion Dam
Engineering Heritage Marker Ceremony

PROGRAM

**Acknowledgment of Traditional Ownership of Land
Formal welcome, recognition of distinguished guests, apologies**
Mr Don Young, FIEAUST, Past Chairman, Engineering Heritage WA

Introduction
by Mr Don Young of Mrs Helen Pedersen, FIEAUST CPEng,
President, Engineers Australia WA Division

Engineers Australia Engineering Heritage Recognition Program
Mrs Helen Pedersen

Introduction by Mr Don Young of Mrs Sue Murphy FIEAUST CPEng,
Chief Executive Officer, Water Corporation of Western Australia

Ord River Diversion Dam
Mrs Sue Murphy

Unveiling of Interpretation Panel
Ms Eva Skira, BA (Hons), MBA, Chairman, Board of Water Corporation
of Western Australia

Acceptance of Panel
Ms Eva Skira

Closing Remarks
Mr Don Young

Immediately following the ceremony there will be a conducted
walk across the Diversion Dam followed by a light lunch at the Swim
Beach venue.

Saturday, 20 July 2013

HERITAGE RECOGNITION

In response to a nomination by Engineering Heritage WA the Ord River Diversion Dam has been awarded a national Engineering Heritage Marker by Engineering Heritage Australia which conducts a heritage recognition program within Engineers Australia. The program focuses attention on the role played by engineers and engineering in the development of the nation and encourages the physical conservation of Australia's important engineering heritage works.

Ord River Diversion Dam Engineering Heritage Marker Ceremony

Saturday, 20 July 2013

05

1. Transferring bulk cement into SS Dulverton at Fremantle wharf
2. 95 tonne radial gate being raised - 1962
3. Radial gates being trial assembled in Vickers Hoskins' Perth workshop.
4. Bandicoot Bar at commencement of excavation
5. Unloading cement at Wyndham wharf



A NEW ERA BEGINS

When Prime Minister Sir Robert Menzies officially opened the Ord River Irrigation Scheme on 20 July 1963, he symbolically marked the end of a long period of dreaming and planning and the beginning of a new era of reality for an agricultural industry in Western Australia's far north. In his opening speech, the PM said the irrigation area was the 'most exciting place in Australia at this moment'.

For about 80 years the region had seen European settlers' cattle grazing on sprawling pastoral leases that were established in the grasslands in the 1880s by explorer and land agent Alexander Forrest.

Damming the Ord River was first mentioned officially in the early 1900s, and by the late 1930s the State Government was investigating the establishment of an irrigation scheme.

Amid scientific investigations of the land, Russell Dumas, the WA Director of Works and Buildings,

spent three weeks in 1941 travelling on horseback along the Ord River course to assess the area and identify possible dam sites.

In the same year, a fledgling research station was established at Carlton Reach privately with support from the State Government, and five years later the Kimberley Research Station, a joint venture by the State and Federal Governments involving the CSIRO, was established on the black soil of the Ivanhoe Plain 16 kilometres downstream.

It is now the Frank Wise Institute of Tropical Agriculture. Twelve years of research indicated that sugar cane, rice, cotton, safflower and other oil seeds were likely to succeed with a sufficient, reliable water supply. Work began in earnest on planning an irrigation scheme harnessing the huge volumes of water that tumbled down the Ord River during the summer wet season making it one of Australia's fastest flowing rivers.

FUNDING ARRIVES

In 1959 the Commonwealth Government made a grant of five million pounds (about \$140 million at 2013 prices) to the Western Australian Government, most of which was for constructing irrigation channels, pumping stations, the Ord River Diversion Dam and the support town of Kununurra (derived from a word meaning 'big waters' in the local indigenous language). In the initial stage about 10,000 acres (4,500 hectares) of land was cleared and graded for farms irrigated through the 25km main (M1) channel and more than 55km of subsidiary channels.

Overall responsibility for planning and supervision of

the scheme passed to the state Public Works Department (PWD). Limited funding dictated that the diversion dam be built before a main storage dam further upstream (completed in 1972) to provide protection from sudden huge inflows. This was not usual engineering practice, but the design of the diversion dam included large radial gates to prevent flooding.

Most of the detailed design of the dam's concrete, mechanical and electrical works was carried out by the PWD. John Lewis, the Chief Design Engineer, had the idea for the radial gates from a dam that incorporated four gates in Montana, USA, that he had visited on an earlier study tour.

WORK BEGINS

In July, 1960, Christiani Nielsen Clough, a joint venture by a Danish and a Perth based company, won a contract worth 2.9 million pounds (about \$78 million at 2013 prices) to construct the dam. Another contract of 763,000 pounds (more than \$20 million) was awarded to Vickers Hoskins of Perth for the prefabrication of the radial gates which give the dam its distinctive appearance.

Contractor offices, workshops, storage facilities, aggregate screening and concrete batching facilities were established on the river bank. The township of Kununurra had been established by the PWD 6 km from the dam site to house project administrative staff.



Scale model of dam in PWD Hydraulics Laboratory, Perth
(Photo courtesy John Lewis)



Sir David Brand



Mr Leif Ott Nilsen

onto a quartzite bar in the river, named Bandicoot Bar.

The radial gates were for many years operated automatically, but because of problems with the ageing control system, manual operation was introduced some 20 years ago. The gates are operated on most days of the year to adjust for varying flows from the hydro power plant at the main Ord Dam and for demand from the irrigation scheme. The opening rate is much higher in wet seasons due to rainfall inflows to the river between Kununurra and the main dam.

The dam also comprised concrete abutments and a precast prestressed bridge spanning the spillway carrying a 6.7 metres wide roadway. A total of 41,000 cubic metres

of concrete was used for the dam while 350,000 cubic metres of fill was used to construct 4.8km of levee banks and miscellaneous earthworks. Mobilisation and preliminary works were carried out before the onset of the 1960-61 wet season, and work began in earnest in March, 1961.

The dam's construction was considered a significant technical achievement, given the remoteness of the site, basic communications and difficult seasonal climatic conditions with sudden river flows.

It was the first major barrage with radial gates built in Australia and was the first major civil engineering project constructed by private enterprise for the PWD of Western Australia.



Sir Charles Court



Mr D.C. Munro



Mr H.E. Hunt



Mr J.G. Lewis



Mr R. A. Hamilton

ORD RIVER DIVERSION DAM DATA:

Owner:	Water Corporation		
Construction project period:	1959-63		
Purpose:	To divert water from the Ord River to irrigation land		
Designer:	Public Works Department WA		
Main contractor:	Christiani & Nielsen Clough joint venture		
Manufacturer of radial gates:	Vickers Hoskins		
Construction:	20 steel radial gates within concrete piers and spillway		
Length of spillway:	335 metres		
Dimensions of gates:	height	11.3 metres	
	width	15 metres	
	weight	96.5 tonnes	
Average annual discharge of water through gates:	About 337 gigalitres (billion litres) including a permanent flow to support the down-river environment.		
Annual water supply to irrigation scheme:	Nearly 145 gigalitres		

PRINCIPAL PEOPLE ASSOCIATED WITH THE PROJECT:

Sir David Brand	Premier of Western Australia 1959-71
Sir Charles Court	Minister for the North West 1959-71 Premier 1974-82
Mr Don Munro	Project Engineer, Public Works Department WA
Mr Harold Hunt	Construction Manager, Public Works Department WA
Mr John Lewis	Engineer for Planning, Design and Investigation, Public Works Department WA
Mr Roy Hamilton	Resident Engineer, Public Works Department WA
Mr Leif Ott Nilsen	Manager, Christiani & Nielsen Australia



1. Bandicoot Bar, late 1960.
2. East abutment and spillway sections formed ready for concreting after rock excavation, early 1961.
3. Pier and radial gate construction well advanced in mid 1962.
4. Radial gate being raised in 1962.
5. Early 1963, showing dam storing water and painting of gates in progress.
6. General Plan of Region 1959.
- 7.8. Commemorative Plaques.

that began in 2010 and will more than double the irrigation area, mostly for a large scale sugar industry, and take the region closer to reaching its full potential as a world class agricultural production area.

15,000 hectares of irrigation land producing more than 60 crop varieties including fruit, vegetables, rice, sorghum and sandalwood representing a \$120 million annual economy. The scheme is being greatly expanded under a \$320 million stage 2 development project

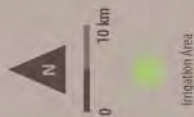
maintain stable water levels at the diversion dam. It also enabled construction of a hydro-electric power station in 1995-96 supplying Kununurra, Wyndham and the Argyle diamond mine. The two dams eventually provided water to almost

A WORK IN PROGRESS

The pioneering Ord River irrigation scheme has seen chequered development in the 50 years since it was established, with its economic viability questioned at times. It decentralised agricultural production in Western Australia, experiencing both crop failures

and successes in the process. The first main crop, cotton, was abandoned in 1974 due mainly to insect pests and a drop in world cotton prices. In 1972 the Ord River Dam was completed 48 km upstream to produce the massive storage reservoir, Lake Argyle, and

maintain stable water levels at the diversion dam. It also enabled construction of a hydro-electric power station in 1995-96 supplying Kununurra, Wyndham and the Argyle diamond mine. The two dams eventually provided water to almost



Engineering Heritage WA wishes to thank the following for their assistance in preparing the nomination for a national Engineering Heritage Marker for the Ord River Diversion Dam:

**Mr Uffe B Hansen, Deputy
Project Manager for Christian
Nielsen Clough 1960 – 1961;**

**Mr Andrew Barker, President,
Kununurra Historical Society,
2012 – 2013**

Ord River Diversion Dam
Engineering Heritage Marker Ceremony



APPENDIX 4 – Media Articles

Water Corporation Media Release, 22 July 2013



Media Release

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22 July 2013

Double celebration for Ord River Diversion Dam

- **Ord River Diversion Dam celebrates 50 years**
- **Dam awarded prestigious Heritage Marker by Engineering Heritage Australia**

In a double celebration the Ord River Diversion Dam has celebrated 50 years since its opening and has been awarded an Engineering Heritage Marker by Engineering Heritage Australia. The award followed the preparation of a detailed nomination by Engineering Heritage WA, the heritage arm of Engineers Australia, Western Australia Division.

The Water Corporation accepted the marker at a ceremony held at Swim Beach, near the dam in Kununurra, last Saturday.

Water Corporation Chief Executive Officer Sue Murphy said the Engineering Heritage Marker was a fitting tribute to such a vital piece of water infrastructure.

“Receiving the marker was the perfect way to celebrate the dam’s 50 years of operation and to recognise the importance of water in the development of Western Australia,” Mrs Murphy said.

“When damming the Ord River was first conceived it was a huge undertaking, with decades of investigations and planning finally culminating in a five million pound grant from the Commonwealth Government in 1959.

“In today’s terms, that is an investment of \$140 million, so it was an achievement well ahead of its time and one that paved the way for successful agriculture in the region.

“The dam’s construction was considered a significant technical achievement, given the remoteness of the site, basic communications and difficult seasonal climatic conditions with sudden river flows.”

The design of the project was the responsibility of the Public Works Department of Western Australia. Mr John Lewis, who was PWD Engineer for Planning and Design, Hydraulics Section, 1954 – 1964, and who led the project design team, was present at the ceremony, as were a number of other former PWD engineering staff (or their relatives) who were associated with the design or construction supervision.

Engineering representatives of the main construction contractor, Christiani Nielsen Clough, who were involved with the dam construction, were also present.

The Ord River Irrigation Project was officially opened on 20 July 1963 by the then Prime Minister Sir Robert Menzies. The opening marked the start of a new era in agriculture in Western Australia's far north.

This is the second Heritage Marker to be awarded to Water Corporation in as many years, with Perth's First Public Water Supply Scheme recognised in October 2012, 121 years after it first delivered water to the city from a reservoir in the hills at Carmel.

Engineering Heritage Markers recognise important historic feats of engineering success across Australia.

Did you know?

- The Ord River Diversion Dam is commonly known as the Kununurra Diversion Dam.
- All construction materials, except concrete aggregates, were shipped from Fremantle to the port of Wyndham, then transported 100km by road to the dam site.
- A total of 41,000 cubic metres of concrete was used for the dam, while 350,000 cubic metres of fill was used to construct 4.8km of levee banks and miscellaneous earthworks.

Media contact:

Water Corporation media team

P: 9420 2555

16 Echo News Diversion Dam anniversary

The Kimberley Echo
Thursday, July 18, 2013

Dream of the north becomes reality

■ Rourke Walsh

It's the project that earned a fledgling town the tag "most exciting place in Australia" from Sir Robert Menzies and this weekend Kununurra Diversion Dam turns 50.

The dam was completed and officially opened on July 20, 1963 after being built over three years to service the Ord River Irrigation Area with water for agricultural endeavours.

The Diversion Dam features 20 radial flood gates which regulate the release of water into the lower Ord River and maintain the level of Lake Kununurra so it can be gravity irrigated by flow controllers.

The creation of the lake-flooded section of the Ord River valley formerly known as Carlton Reach, which was at times a 10km-long waterhole held back by natural rock barrier Bandicoot Bar.

Kununurra Historical Society president Andrew Barker said the dam was a big change for the river, the look of the valley and for local Aboriginal people.

"The Diversion Dam was built on Bandicoot Bar which was like a natural dam itself and held back Carlton Reach," he said.

Mr Barker said he doubted Kununurra would exist today if not for the dam and the subsequent agricultural developments.

"It was certainly established specifically, at first, to build the Diversion Dam and then the top dam (Lake Argyle) which wasn't finished until eight or nine years later," he said.

"It really marked the commercial agriculture in the region."

Just month before it was opened, the almost complete dam was viewed with awe by Queen Elizabeth and her consort the Duke of Edinburgh Prince Philip on a visit to the region.

"(At the opening) Menzies read out a telegram from the Queen apologising that she wished she could have been there, she of course had visited 125 days beforehand," he said.

"After reading the telegram he made the comment that this was the 'most exciting place in Australia' at the time and of course it was a very exciting place."

"Because it was a national project, similar to the Ord Stage 2 is today, I guess it was of local, State and national significance."



The Diversion Dam wall and gates from the town side in 1962. Pictures: Kununurra Historical Society archives



Looking east across the Ord River Diversion Dam construction site.



The Diversion Dam midway through construction.



Drillers at Bandicoot Bar in 1959.



Prime Minister Robert Menzies inspecting agricultural projects after opening the Diversion Dam.

This Saturday, KHS with Engineering Heritage WA will unveil a new interpretive panel at the Kununurra Swim Beach detailing the history of the dam.

The opening will incorporate invited guests, including people who worked on the dam and their fam-

ily and will conclude with a walk over the dam.

The Kununurra Museum will be open from 2pm for pioneer engineers, VIPs and guests.

■ CARTOON PAGE 6



The day Prime Minister Robert Menzies opened the Ord River Diversion Dam - July 20th 1963.

Ord River Dam Article for EA WA Electronic Newsletter, July 2013

Heritage Recognition of Ord River Diversion Dam

The first stage of the Ord River Irrigation Project was officially opened on 20 July 1963 by then Prime Minister of Australia, the Hon Sir Robert Menzies. It was thus fitting that the Water Corporation of WA and Engineering Heritage WA should jointly host a ceremony exactly 50 years later, on the bank of the Ord River near the Ord Diversion Dam, to commemorate the award by Engineering Heritage Australia of an Engineering Heritage Marker to the Diversion Dam.

Water Corporation Board Chairman Eva Skira and Engineers Australia WA Division President Helen Pedersen jointly unveiled an interpretation panel describing the investigations, planning, design and construction of the dam.

Water Corporation Chief Executive Officer Sue Murphy said the Engineering Heritage Marker was a fitting tribute to such a vital piece of water infrastructure.

“Receiving the Heritage Marker was the perfect way to celebrate the dam’s 50 years of operation and to recognise the importance of water in the development of Western Australia,” Mrs Murphy said.

“When damming the Ord River was first conceived it was a huge undertaking, with decades of investigations and planning finally culminating in a five million pound grant from the Commonwealth Government in 1959.

“In today’s terms, that is an investment of \$140 million, so it was an achievement well ahead of its time and one that paved the way for successful agriculture in the region.

“The dam’s construction was considered a significant technical achievement, given the remoteness of the site, basic communications and difficult seasonal climatic conditions with sudden river flows.”

Among the 50 guests at the ceremony was John Lewis, who as Engineer in Charge of Planning, Design and Investigation for the Public Work Department WA, 1954 – 1964, had prime responsibility for the design of the irrigation scheme’s engineering works.

Information about some Western Australian sites which have received Engineering Heritage Australia awards can be viewed on the Engineers Australia WA [website](#). The Ord Diversion Dam information will be added in the near future.

By Don Young FIEAUST



Eva Skira (left) and Helen Pedersen
unveiling the interpretation panel
Photo by M Corboy

Ord River meanders its way home

The nation-building irrigation scheme has seen a few stops and starts over the decades, but it now appears to be bearing fruit, **Kim Macdonald** reports.

Former prime minister Robert Menzies was surrounded by flies and cotton fields 50 years ago when he declared Kununurra "the most exciting place in Australia".

Back in 1963, the remote North West town was little more than a collection of farms, but it garnered attention from across the globe.

Queen Elizabeth II visited the town the same year, in what is believed to have been the only occasion Her Majesty ever stepped on to a dirt runway.

The humble town's drawcard was the Ord River Irrigation Scheme — a project that opened an agricultural industry in the State's inhospitable north.

It put the town at the edge of a new frontier and created a region that was predicted to become the State's food bowl.

Work began in 1959 with a design that tried to prevent seasonal flooding and divert water from the Ord River for irrigation.

The diversion dam was built first, using 20 radial floodgates to regulate the release of water into the lower Ord River and maintain Lake Kununurra.



The diversion dam controls the flow of water from into the lower Ord River and maintains Lake Kununurra.
Picture: Trevor Collens

A second dam, built in 1972, fed 10,000m³ of water — or nine times the volume of Sydney Harbour — into Lake Argyle.

The two dams continue to provide water for nearly 15,000ha of irrigated land, which produce more than 60 crops and underpin a \$120 million annual agricultural economy.

In current values, the cost of stage one was relatively modest.

The Commonwealth committed a £5 million grant — worth about \$140 million today — for the creation of irrigation channels, the pumping station and diversion dam. Perth and Danish company Christiani Nilsen Clough then won a construction contract for £2.9 million.

Another contract for £783,000 was awarded to Vickers Hoskins of Perth to manufacture the radial gates.

The construction and engineering of the project was challenging given the remoteness of the site, extreme weather and sudden river flows.

The 15m-high radial gates, which each weigh more than 85 tonnes, were installed between reinforced concrete piers on a quartzite bar in the river.

They are adjusted for varying flows of rainfall.



The construction and engineering of the project was challenging given the remoteness of the site.

There are questions over whether the scheme lived up to its original hype, and the economic viability of the scheme has been questioned over the years, particularly after crop failures in early cotton fields.

By the 1980s, only 10 per cent of the possible irrigation area was under cultivation. Now, almost all the possible irrigation area is cultivated.

The State Government recently reignited debate over the scheme's success



by spending \$311 million to extend the main irrigation channel by 31km and build 40km of sealed roads to open up more than 13,000ha.

Regional Development Minister Brendon Grylls believes that after 50 years, Kununurra is finally coming of age.

In a sign of renewed confidence, bulldozers last month cleared the first block of what will be 13,400ha of new farming land. This farm will run under Chinese-backed Kimberley Agricultural Investment, which plans to invest \$700 million.

The Ord River Diversion Dam was last month awarded a heritage marker by Engineering Australia.

Water Corporation chief executive Sue Murphy said the dam's construction was a challenge. "When damming was first conceived it was a huge undertaking, with decades of investigations and planning," she said. "It was an achievement ahead of its time and paved the way for successful agriculture in the region."

Robert Menzies inspects a cotton farm in Kununurra in 1963. Picture: Kevin Richards, The Kununurra Historical Society



The Queen and Prince Phillip, left, with David Brand at Kununurra.

Heritage Marker for Ord River dam

The Ord River Diversion Dam in Western Australia has been awarded an Engineering Heritage Marker by Engineering Heritage Australia.

The marker was accepted by the Water Corporation at a ceremony celebrating the dam's 50th anniversary held at Swim Beach, near Kununurra, in July.

The award followed the preparation of a detailed nomination by Engineering Heritage WA.

Water Corporation chief executive Sue Murphy said the Engineering Heritage Marker was a fitting tribute to such a vital piece of water infrastructure.

"Receiving the Heritage Marker was the perfect way to celebrate the dam's 50 years of operation and to recognise the importance of water in the development of Western Australia," she said.

"When damming the Ord River was first conceived it was a huge undertaking, with decades of investigations and planning finally culminating in a five million pound grant from the Commonwealth government in 1959.

"In today's terms, that is an investment of \$140 million, so it was an achievement well ahead of its time and one that

paved the way for successful agriculture in the region.

"The dam's construction was considered a significant technical achievement, given the remoteness of the site, basic communications and difficult seasonal climatic conditions with sudden river flows."

The Ord River Irrigation Project was officially opened on 20 July 1963 by the then prime minister Sir Robert Menzies. The opening marked the start of a new

era in agriculture in Western Australia's far north.

The dam was designed by the state's Public Works Department. The project design team was led by John Lewis, who attended the ceremony along with a number of former engineering staff associated with the design and construction supervision.

Also present were engineering representatives of the main construction contractor Christiani Nielsen Clough.



The 95t radial gate being raised for the Ord River Diversion Dam in 1962.

ORD RIVER DIVERSION DAM 1963–2013

The previous *Boab Bulletin* mentioned the Engineering Heritage Marker presented to the Water Corporation by Engineering Heritage WA on 20 July 2013. That date was the 50th anniversary of the formal opening of the Ord River Irrigation Project by Prime Minister Robert Menzies, and the marker recognised the engineering heritage significance of the Ord River Diversion Dam.

The opening of the Ord River Irrigation Project was the start of a new era. Aboriginal people had occupied the fertile Ord River valley for thousands of years, and cattle had grazed there for almost 80 years. Now, after decades of dreaming and planning, water storage and irrigated farming had become a reality.

Ord River irrigation had been visualised from the early 1900s but it was 1936 before systematic research began. Agricultural scientist Kim Durack experimented with fodder crops on Argyle Station; Jewish refugee settlement on irrigated farms was proposed but not implemented; and the state government looked for dam sites and established a small research station at Carlton Reach. The initial focus was on the potential for using irrigated pasture to improve the quality of the local beef but, as the years slipped by, the research embraced tropical agriculture.

Kimberley Society member John Lewis, who from 1954 to 1964 was the Public Works Department WA Engineer for Planning, Design and Investigation, Hydraulics Section, recalled the background to the decision to proceed with the Ord River Irrigation Project. In 1958, he said, Prime Minister Menzies made an election promise that, if his government was re-elected, £5 million would be made available to the Western Australian Government for northern development, providing the money was spent by 1963. At that time, the Prime Minister was unaware that the state government was sufficiently advanced in its planning to allow construction to commence in 1960 and the irrigation project, of which the diversion dam was the centrepiece, to be in place by early 1963.

It was unusual for a diversion dam to be built before, and without the protection of, a main storage dam further upstream. Yet, due to the funding constraints, that is what happened. The main dam was completed in 1972, producing the massive storage reservoir, Lake Argyle, and maintaining stable water levels at the diversion dam. It received a Historic Engineering Marker in 2004.

The PWD WA investigations prior to the detailed design of the diversion dam concluded that a maximum flood flow of about 57,000 cubic metres per second could be expected at the proposed site. The fortunate occurrence of a quartzite bar (Bandicoot Bar) across the river, on which the diversion dam could be anchored, provided a convenient location to store water to reticulate to the proposed farm lots. This position, however, imposed some difficulties in the layout of the 335-metre spillway because it put the dam on a bend of the river and at a slightly oblique angle. A model was built at PWD's Perth laboratory to confirm theoretical calculations and assumptions about the hydraulic design.



Bandicoot Bar at commencement of excavation (Photo courtesy John Lewis)

A civil engineering project of the scale of the Ord River Diversion Dam had never been attempted in the north of the state and it faced both technical and logistics challenges. The spillway, abutments and piers, which support 20 steel radial gates each weighing 95 tonnes, required 41,000 cubic metres of concrete. Wet season flooding curtailed work in the river bed from December to March, and the remote site—3,000 kilometres from Perth mostly by unsealed road—presented multiple difficulties. Construction materials except concrete aggregates were shipped from Fremantle to the port of Wyndham, then driven 100 kilometres to the site.

The radial gates, used for storage and flood control, are a key feature of the operation of the diversion dam. John Lewis had visited a dam equipped with radial gates in Montana USA in 1952, when on an overseas study tour. Contact with the designers, the US Bureau of Reclamation, resulted in the drawings of the Montana dam gates generously being provided free of charge. The majority of detailed design of the concrete, mechanical and electrical works was carried out by the PWD WA staff with the design of the concrete roadway the responsibility of the Main Roads Department of WA.

Tenders for the construction of the diversion dam were called in the first half of 1960 and the successful tenderer, Christiani & Nielsen Australia – Clough joint venture (CNC), was awarded a £2.9 million contract in July 1960. Contract completion was to be 30 November 1962. This was the first major civil engineering contract let by the PWD WA to private enterprise. Another major contract, valued at £763,000, for the prefabrication and trial assembly of the radial gates, was awarded to Perth firm, Vickers Hoskins Pty Ltd.

Before the construction contractor mobilised, the PWD WA began establishing the town of Kununurra (four kilometres away), site access roads, a town water supply, a power station and an airstrip suitable for a De Havilland Dove aircraft. Mobilisation of the contractor's accommodation, offices, workshops, concrete plant and some preliminary work in the river bed commenced in late 1960 but most of the construction took place in the 1961 and 1962 dry seasons. A feature of the logistics was the conversion of the State Shipping Service vessel *Dulverton* to a bulk cement carrier. A total of 15,000 tonnes of cement was shipped in cargoes up to 1400 tonnes on each voyage from Fremantle to Wyndham, where it was stored in silos before being carted to the site.

CNC completed the concrete work by 30 November 1962 but the painting of the gates was not completed until early 1963. Work had continued during the 1962–1963 wet season by placing the maintenance stop logs upstream of the gates thus allowing work to continue on individual gates although the dam was storing water.

In recognising the engineering heritage significance of the Ord River Diversion Dam, the Statement of Significance in the nomination document identifies the following points:

- The construction of the Ord River Diversion Dam was a highly significant event in the development of the East Kimberley region in Western Australia.
- The Ord River Valley had been a pastoral area since the late 1880's but the declining importance of the area for the cattle industry paved the way for the establishment of an irrigated farm development on the black soil plains of the lower Ord valley in the early 1960s.
- The first stage of the Ord River Irrigation Project included the Ord River Diversion Dam, a well planned barrage at a strategic location across the river at Bandicoot Bar, providing gravity flow to the main irrigation channel serving the first irrigated farm lots.
- The diversion dam was a significant successful technical and logistical achievement, overcoming multiple difficulties such as an extremely remote site, basic transport and communication facilities and adverse seasonal climatic conditions.
- The successful completion of the dam was a credit to the planners, designers, offsite suppliers and manufacturers and contractors involved.

Don Young & Cathie Clement

The start of a New Era in 1963

The Ord River Diversion Dam & the Ord River Irrigation Project

On 20 July this year, a ceremony was held on the east bank of the Ord River, near Kununurra, Western Australia, to commemorate the award of an Engineering Heritage Marker to the Ord River Diversion Dam. The 20th of July was the 50th anniversary of the official opening of the Ord River Irrigation Project by the then Prime Minister Sir R G Menzies.

The New Era refers to the transition from nearly 80 years of pastoral use of the fertile Ord River valley to that of irrigation farming, which in turn followed 20 years of research into crops which could be grown if sufficient water was available.

In 1958 Prime Minister Menzies had made an election promise that if his government was re-elected, £5 million would be made available to the Western Australian Government for northern development, providing the money was spent by 1963. The Prime Minister believed that the WA Government would not be able to meet the time condition in respect of the irrigation project.¹ He was unaware that the WA Government was sufficiently advanced in its planning to allow construction of the diversion dam to commence in 1960. The irrigation project, of which the diversion dam was the centrepiece, was completed by early 1963.

Water from the small lake behind the diversion dam flowed into a main irrigation channel and thence to farms on the Ivanhoe Plain downstream. The town of Kununurra was established not far from the diversion dam site, and it serviced the later construction of the main Ord River Dam and Lake Argyle about 30 kilometres upstream.

West Australian Public Works Department (PWD) investigations prior to the detailed design of the diversion dam concluded that a maximum flood flow of about 57,000 cubic metres per second could be expected at the proposed site. It was unusual for a diversion dam to be built before, and without the flood protection of, a main storage dam further upstream. However the limited funding issue dictated that the main dam be built after the diversion dam and it wasn't completed until 1971.

The exact location of the diversion dam was decided by the fortunate occurrence of a quartzite bar (Bandicoot Bar) across the river on which the dam could be anchored, and this was also a convenient location to store water to reticulate to the proposed farm lots.

A civil engineering project of the scale of the Ord River Diversion Dam had never before been constructed in the north of the state. It had to overcome considerable communication, technical and logistics challenges. 41,000 cubic metres of reinforced and prestressed concrete, 650 tonnes of reinforcing steel and 240 tonnes of high tensile prestressing steel were required to construct the spillway,

abutments and the piers which supported 20 steel radial gates each weighing 95 tonnes.

All of this material, plus staff, living quarters, site offices, workshops, a concrete plant and so on, and on, had to be moved to an extremely remote site – 3000 km by mostly unsealed road from Perth. And adverse seasonal climatic conditions with wet season flooding curtailed work in the river bed from December to March.



The Bandicoot Bar on the Ord River in late 1960, before dam construction started. Site offices, workshops and a concrete plant are visible on the East bank. Photo courtesy J. Lewis.

Prior to engagement of the construction contractor the PWD WA had established the town of Kununurra, 4 km from the dam, with site access roads, a town water supply, a power station and an airstrip suitable for small planes.

Mobilisation of the contractor's accommodation,

offices, workshops, concrete plant and some preliminary work in the river bed started in late 1960 but most of the construction took place in the 1961 and 1962 dry seasons.



Transferring bulk cement into SS Dulverton at Fremantle Wharf.

Photo courtesy Christiani & Nielsen.

A feature of the logistics was the conversion of the State Shipping Service vessel *Dulverton* to a bulk cement carrier and a total of 15,000 tonnes of cement was shipped in cargoes up to 1400 tonnes on each voyage from Fremantle to Wyndham, where it was stored in silos before being carted by road to the site.

¹ According to John Lewis, who from 1954 to 1964 was the Public Works Department WA Engineer for Planning, Design and Investigation, Hydraulics Section

The majority of detailed design of the concrete, mechanical and electrical works was carried out by the PWD WA staff. However a key feature of the operation of the diversion dam was the radial gates used for storage and flood control. John Lewis had visited a dam equipped with radial gates in Montana USA in 1952, when on an overseas study tour. Contact with the designers, the US Bureau of Reclamation, resulted in the drawings of the Montana dam gates generously being provided free of charge. A major contract, valued at £763,000, for the prefabrication and trial assembly of the radial gates in Perth, was awarded to Perth firm, Vickers Hoskins Pty Ltd.



Radial gates trial assembled in Vickers Hoskins' Perth workshop.
Photo courtesy Water Corporation of WA.

Tenders for the construction of the diversion dam were called in the first half of 1960 and the successful tenderer, Christiani & Nielsen Australia – Clough joint venture (CNC), was awarded a £2.9 million contract in July 1960. Contract completion was to be 30 November 1962. This was the first major civil engineering contract let by the PWD WA to private enterprise.



Rock excavation at Bandicoot Bar, protected by a temporary upstream levee.
Photo courtesy Christiani & Nielsen

CNC completed the concrete work by 30 November 1962 but the painting of the gates was not completed until early 1963. Work had continued during the 1962–1963 wet season by placing the maintenance stop logs upstream of the gates thus allowing work to continue on individual gates although the dam was storing water.



The diversion dam in early 1963. The dam is storing water & gate painting is in progress.
Photo courtesy Kununurra Historical Society.

The gates were fully completed on 8 March 1963 and the dam was officially opened by the Prime Minister of Australia, the Right Honourable Sir Robert Menzies, on 20 July, 1963.
Photo courtesy Kununurra Historical Society.



Opening of the diversion dam in 1963 enabled the development of a major agricultural industry in the region, accompanied by the growth of towns & communities. It led to important decentralisation of agricultural production in the state, reducing the reliance on produce delivered to northern districts from the south-west or imported from other states. The irrigation scheme was improved with completion in 1971 of the larger Ord River Dam, further upstream, which produced the massive storage reservoir Lake Argyle.


An Engineering Heritage Recognition ceremony was held on the 50th Anniversary of Menzies' opening of the diversion dam – on the 20th July 2013. The ceremony was attended by over 50 guests, including former PWD and Christiani Nielsen Clough staff members (or relatives) who had been associated with dam's design or construction. An interpretation panel describing the planning, design and construction of the dam was jointly unveiled by the Chairman of the Water Corporation of WA, Ms Eva Skira, BA(Hons), MBA, and the President of EA WA Division, Mrs Helen Pedersen, FIEAust, CPEng.

From Don Young, EHWA.

Ms Eva Skira (left)
and
Mrs Helen Pederson
(right)

Photo by Emily Hunter






ENGINEERS AUSTRALIA

ORD RIVER DIVERSION DAM

- THE START OF A NEW ERA -



WATER AUSTRALIA

HISTORY OF THE ORD RIVER

EARLY PASTORAL USE

The position of the Ord River in the Kimberley region was first identified by the explorer, James Stirling, in 1829, during which he named the Ord River after the Governor of Western Australia, Sir Harry Ord. He subsequently set himself up as a land agent in the Ord River area. The first pastoralists to settle in the area were the Duracks, Emus and Kilroy families. In the first half of 1885 the Duracks and Ben Kilroy mustered 7250 cattle and sheep on the Ord River. In 1885 the Ord River was 4000 km long and 1885 to 1887 the Ord River was 4000 km long and 1885 to 1887 the Ord River was 4000 km long.

AGRICULTURAL RESEARCH

In 1941 the newly appointed Western Australian Director of Agriculture, Ronald Macdonald, requested a report on the Ord River area to be established. Later that year the Ord River area was established. The Ord River area was established in 1941. The Ord River area was established in 1941. The Ord River area was established in 1941.


BUILDING OF THE DIVERSION DAM

The Public Works Department of WA (PWD) investigations prior to the detailed design of the diversion dam concluded that a maximum flood flow of about 57,000 cubic metres per second could be diverted from the Ord River. The diversion dam was built across the river (Barramundi River), on which the diversion dam could be anchored, was a convenient location to close water to recirculate to the proposed irrigated dam site.


A key feature of the diversion dam operations was the radial gates to be used for storage and flood control. The radial gates were designed to be closed during periods of high flow and opened during periods of low flow. The radial gates were designed to be closed during periods of high flow and opened during periods of low flow.

The diversion dam was built across the river (Barramundi River), on which the diversion dam could be anchored, was a convenient location to close water to recirculate to the proposed irrigated dam site.


EMINENT PERSONS ASSOCIATED WITH ORD RIVER DIVERSION DAM



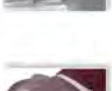
Mr R. A. Nether
Chief Engineer, PWD
1959 - 1971



Mr J. G. Lamb
Chief Engineer, PWD
1971 - 1982



Mr R. A. Nether
Chief Engineer, PWD
1959 - 1971



Mr J. G. Lamb
Chief Engineer, PWD
1971 - 1982

PLANNING OF THE IRRIGATION SCHEME

The Ord River Irrigation Scheme was planned to bring the high volume of water flowing down the Ord River to the agricultural lands of the Ord River. The Ord River Irrigation Scheme was planned to bring the high volume of water flowing down the Ord River to the agricultural lands of the Ord River.

EARLY DIVERSION DAM CONSTRUCTION

The diversion dam was built across the river (Barramundi River), on which the diversion dam could be anchored, was a convenient location to close water to recirculate to the proposed irrigated dam site.

ORD RIVER DIVERSION DAM

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